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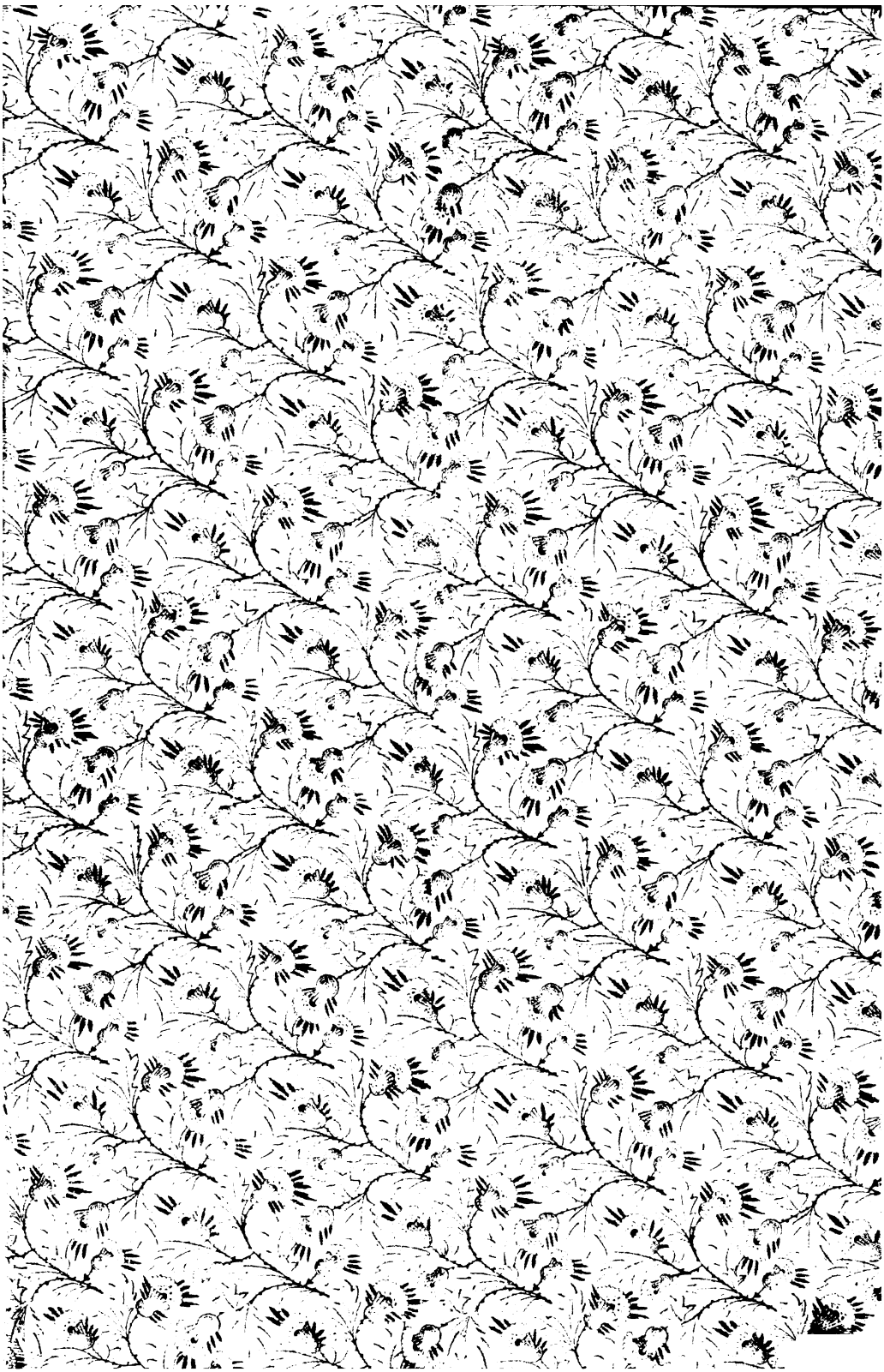

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From Prof. W. H. Harrington

THE

SINGLE SERPENTINE COURSE OF THE MOON

ROUND THE SUN AND THE EARTH.

Read at a Meeting of Members of the Society of Science, Letters and Art, of London,

SIR HENRY VALENTINE GOOLD, BART.,

PRESIDING.

"It would appear that there is a peculiarity in the moon's motion entirely unforeseen."—HALLEY.

"I suppose it is known to all Fellows of the Society, that of late years there have been indications of something having gone fundamentally wrong in the lunar theory."—PRESIDENT OF ROYAL ASTRONOMICAL SOCIETY, *Burlington House, 13th April*, 1883.

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1883.

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Phillips, William Henry

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THE SINGLE SERPENTINE COURSE OF THE MOON ROUND THE SUN AND THE EARTH.

By WILLIAM HENRY PHILLIPS, C.E.

[*Read October 17th*, 1883, *before the Society of Science, Letters and Art, of London.* Sir Henry Valentine Goold, Bart. (*the President*), *in the Chair.*]

Sir Henry, Ladies and Gentlemen—In submitting to your consideration my discovery of "the Single Serpentine Course of the Moon round the Sun and the Earth," I advance few arguments, since the reality has to be proved (or disproved) by tests of science.

Having introduced the subject as a discovery, I have to consider what that word implies; and I think you will agree with me that a discovery is essentially the possession of something unknown.

When a startling discovery is first announced, the question from one to another may be "What do you think of it?" and the reply may be "Very wonderful, if true;" while from another who speaks his conception we may hear "It appears to be an evident fact, and the only wonder is that it was not known before."

And such, Sir Henry, Ladies and Gentlemen, is the

wonder to me; and as first possessor of the discovery my desire is to communicate the same to this meeting of the Society of Science, Letters and Art, of London, and thereby to the whole world.

In order to make my extraordinary reversal of the moon's hitherto supposed course intelligible, I cannot escape the necessity of trespassing on your patience, by reference to the incident that prompted the discovery, which incident I endeavour to treat scientifically, and not as a mere idle tale.

By the fracture of a locomotive wheel, followed by experiments and study, I am brought now before you in all humility, and with all possible confidence, to state that it is my belief and conviction that the mixed studies, commencing from the fractured wheel, have led me to the discovery of the moon's real course, and, as a resultant, the finding of certain easy means of solving the most important problem in astronomy—the determination of the nearest approximate distance of the earth from the sun, not only as a mean distance, but as a facile practice available to determine the earth's distance from the sun in all parts of her eccentric orbit; and at some near future time I hope to have the honour of addressing you on the subject of finding the earth's distance from the sun, the working out of which I have reduced to a few simple equations, such as would be worked out by any navigating officer practised in lunar observations.

The special subject of my address to you this evening is, however, limited to the single serpentine course of the moon.

I take it for granted that all astronomers adjudge that both the earth and the moon course annually round the sun with a velocity of over 1,000 miles a minute, and that the

attraction of gravitation between the sun and the earth restrains the earth to her orbital course round the sun at an approximate distance of 92 million miles, and that the moon also travels round the sun at a similar mean distance, and is also restrained by attraction with the sun to travel with the same planetary velocity of over 1,000 miles a minute. And the question naturally arises, how the moon, travelling with such enormous velocity, can be diverted into the anomalous course—that of monthly encircling the earth, and diametrically against her known onward course of a thousand miles a minute round the sun ?

Hitherto the answer has been that the earth carries the moon with her round the sun—an illusion I humbly submit to be untenable in science.

As I have been asked how the fracture of a wheel could have led me to the assumption of my asserted course of the moon, I briefly explain.

Reading the evidence given before a jury empanelled to decide as to the cause of death of two men killed by the fracture of a locomotive wheel, I weighed with amazement the facts clearly proved.

A driving wheel had broken on a spot marked by the fractured wheel, and the two men were killed at a spot many yards in advance of the approaching engine, by a missile of iron of over two cwt., projected to a side line from the fractured wheel.

The verdict being a chance flaw, or some unseen defective workmanship; but the phenomenon that the mass of iron travelled faster than the engine was a neglected problem.

By experiment I found what is now recognised as a fact that the axle of a carriage, cart, or locomotive wheel alone travels just as fast as the vehicle, for that part of the wheel

that touches the ground is in a positive state of rest, while that part of the wheel most distant from the ground travels with a velocity twice that of the vehicle, wherefore it is to be expected that a locomotive, speeding fifty miles an hour, and having a mass of iron exceeding two cwt. attached near the periphery of the driving wheel, will be liable to fracture, from the fact that at every revolution of the wheel the mass of iron is made to travel with a velocity of 100 miles an hour, and the false policy of bringing two cwt. of iron to a state of rest and hurling it into a velocity of 100 miles an hour, and that four times every second, is evidently a waste of many horse power of steam, while endangering human life.

Considering that such is the force of centrifugal strain, whether of a fly-wheel or a locomotive wheel, revolving with extreme velocity, so that thick masses of iron may be torn asunder, and that the smaller the diameter of wheel under like velocities the greater is the centrifugal power and strain, as shown in action by the force-meter. From these promptings my thoughts dwelt on the improbability that the moon, travelling 1,000 times faster than the express train, could be restrained to course in a comparatively small circle round the earth, and therefore I submit an axiom, with a problem for solution, whereby the possibility or impossibility can be determinately proved.

PRACTICE AND THEORY.

I may remark that practice is often held up as in opposition to theory, when it should be seen that theory so-called is no theory unless sound, while practice may be mere uncultivated usage, and only when practice and sound

theory go hand-in-hand can any approach to perfection be expected.

CENTRIFUGAL TENDENCY.

From conversation with practical mechanicians, I have found that the duplex principle of centrifugal tendency is not generally understood, wherefore, with your indulgence, I review this very important consideration—very important in reference to the onward course of the moon round the sun.

It is known that the weighty mass of the circle of a fly-wheel holds an accumulation of power estimated by the mass multiplied by the square of the velocity, and if undue velocity arises the strongest wheel may be fractured, the fragments flying off at a tangent by the force of centrifugal power, and even from an iron blade held in a state of rest the iron sparks fly off in tangents from the knife-grinder's revolving stone. And again, the carriage wheel picks up the mud from a state of rest on the road, which mud, by centrifugal force, is cast off at a tangent into the air.

Such are examples of centrifugal power; and in all such examples centrifugal force is developed without setting up centripetal force.

On the other hand, a sphere travelling in space by its own acquired right line velocity and momentum, travels in a circle under the influence of attraction, that is, of centripetal power alone, and without centrifugal force (except that arising from its axial rotation).

So, mechanism revolving round a metal axis induces centrifugal tendency without centripetal power, while the planets without centrifugal force are acted upon by centripetal force alone, centrifugal tendency being in a measure

set free when attraction diminishes, as when the earth approaches the summer solstice.

That the moon is deflected towards the earth 16 feet in one minute, whatever the velocity of the moon might be, was truly a great discovery, while the error of assuming that the moon by such deflection is caused to travel in a circle or ellpise round the earth, to be by the earth carried round the sun, was a mistake hitherto not duly investigated, hence a great error has been perpetuated even to the present time.

Had Sir Isaac Newton found that the moon travels in a diametrically opposite direction to that assumed, his discovery that the moon gravitated toward the earth 16 feet in one minute would have been the same, and the other great truth would have been bequeathed to us; but considering that the lifetime of the philosopher is a mere minute of arc in the great orbit of time, something is ever left *to be* done, as an addition to the great estate to be bequeathed to future heirs of science.

That the moon travels in a single serpentine course with a velocity always exceeding 1,000 miles a minute I hope to make evident to you, without submitting speculative algebraical propositions or complex mathematical problems, since, by mere familiar geometrical lines, the mystery can be disclosed. In this I follow the advice of the President of the British Association, given in his recent address.

"Pure Geometry," he says, "seems to be of the greatest educational value, and almost indispensable in many applications; it is the inspection of figures which is of the greatest importance in geometry. If this is so (he says), surely every progress in the spread of the knowledge of pure geometry should be welcomed and encouraged, for pure geometry has become a most important instrument for research, rivalling

in power the more or less algebraical methods, and surpassing them all in the manner in which they raise before the mind's eye a clear realisation of the forms and figures which are the objects of investigation."

And in following such excellent guidance, I submit a few geometrical figures, which present "before the mind's eye" the problem to be solved.

The astronomer and the mathematician may test the same by more complex formula, while the engineer, who exercises dynamical and other physical laws in practical and visible action can most conclusively demonstrate the same.

Ponderosity or weight, velocity, momentum, centripetal force or gravity, and centrifugal tendency, being five principles in harmonious and perpetual action in every sphere in the universe, and also five controlling principles, ever regarded and put into operation by the engineer in all the huge physical engines in daily use.

The problem in its simplicity is to draw a straight line as representing the primitive course of any moving body, whether a planet or other ponderous mass, speeding by its own sustaining power, the straight line being the natural primary course of all masses (V. Fig. 6).

From the straight line a perpendicular is raised as radius of a large circle, the radius representing the centripetal power or pull by gravity as to the sun, bearing in mind that in all planetary movements centripetal power and centrifugal tendency adjust themselves to a perfect balance, and so regulate the length of the radius of the orbit round the sun; and the moon may thus be assumed to be drawn away or deflected from the straight line course, so as to travel by its constant planetary velocity in a circle round the sun.

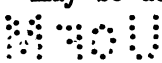
Then with a radius one-fourth the length of the long radius a smaller circle is described, touching the large circle.

The question is, how much stronger must the attraction of gravitation between the earth and the moon be to cause the moon to leave the large circle and travel round the centre of the small circle. My answer is the radius of the supposed large circle being four times the length of the radius of the small circle, the attraction between the earth and the moon under such conditions would be four times as strong as the larger radius of attraction between the sun and the moon. And taking the moon to be, in round numbers, a quarter of a million miles distant from the earth and ninety millions from the sun, the earth's attraction with the moon would be at least 360 times stronger than the attraction between the sun and the moon to cause the moon to leave the circle of radius 90 millions to travel round circle of radius a quarter of a million.

But it is known that the highest estimate given to the earth's attraction with the moon is less than $2\frac{1}{2}$ times the sun's attraction with the moon. *Ergo:* the moon cannot possibly course in a circle or ellipse round the earth, since a pull of $2\frac{1}{2}$ horse power "an engineer would say," cannot possibly be the needed 360 of pull.

Yet it may be asked what evidence is there to show that a mass travelling in a large circle must of necessity (when travelling with same velocity) have a stronger radius of attraction or restraining pull to cause the mass to travel in a smaller circle.

The answer is that astronomy deals with such phenomena by observations and mathematical calculation, from which may be deduced the movements of celestial bodies ever



moving in space beyond the reach of man; while the engineer can handle mechanism governed by the same laws and so give practical evidence as to realities.

The simple piece of mechanism—the force meter—exemplifies theory and practice in unison by showing the rise and fall of the attached barometer of the centrifugal meter while a minature planet is under velocity, and by reference to the prepared tables certain results are found; the results, always reliable, may be varied at pleasure.

While using one small weight the length of radius may be varied, also the diameter of revolutions, the number of revolutions per second, and so the velocity, the momentum, the centripetal and centrifugal strains, and so the five phenomena governing planets in their circuits.

DESCRIPTION OF DIAGRAMS.

Fig. 1 represents the old traditional course of the moon during a lunar month, the moon being supposed to travel to the left from A to B in 24 hours, thence onward to first quarter, to full, to last quarter, to new moon again, so completing a monthly round of the circle or ellipse.

Instead of which impossible course to the east and the left, as we face the south, the moon is really coursing to the west and the right, the distance coursed in 24 hours from A to C being *thirty* times the distance from A to B in 24 hours. And instead of the new moon receding from the sun some 240,000 miles while travelling 360,000 miles to first quarter, the moon has receded the 240,000 miles while coursing onward 11,000,000 miles round the sun, hence the old error must be corrected by reversing the moon's path toward the left and east (fig. 1), to the right and west (fig. 2), and the

distance coursed from new to first quarter must be increased from 360,000 miles, to over 11,000,000 miles, an increase of more than thirty-fold.

Fig. 5, drawn to scale, are courses of the earth and moon during a lunar month, the courses being almost parallel, the moon receding from the sun some half million miles while coursing from new to full, a distance of over 23,000,000 miles, *without any indication of a circular or elliptical course round the earth.*

Fig. 4. The width of the serpentine course of the moon is drawn 8-fold in excess of what it ought to be, in order to show more clearly the relative tendencies of attraction of both the sun and the earth with the moon.

Putting aside the old notion that the earth carries the moon with her round the sun, the earth's real influence in guiding the moon in her planetary course round the sun is easily made evident. As the earth, speeding 1,000 miles a minute, is restrained by attraction with the sun to travel in her orbital course at a mean distance of 92,000,000 miles, so also the moon, speeding by her planetary velocity 1,000 miles a minute, is restrained by the sun's attraction with her to the onward course of nearly 600,000,000 miles a year, and any attraction of the earth with the moon counter to the sun's attraction with the moon acts as in reduction of the sun's attraction, and any reduction of the sun's attraction sets the centrifugal tendency of the moon more or less free; and were the earth's attraction only one-fourth instead of nine-fourths of sun's attraction, the moon would still recede from the sun, and so commence a serpentine course.

That the moon does not plunge into the earth by reason of the earth's attraction being always double the sun's

attraction with the moon can be understood, as the moon's planetary speed onward exceeds 5,000,000 feet a minute, while the earth's diverting pull is only 16 feet a minute.

The governing attraction of both the sun and the earth with the moon may be compared to the governing power of steersmen in a ship of a thousand tons, coursing 15 miles an hour. The two helmsmen, by their combined pull of two or three cwt., control from the straight course to a serpentine course the ponderous ship, although plunging onward with a momentum of 440,000 tons of energy.

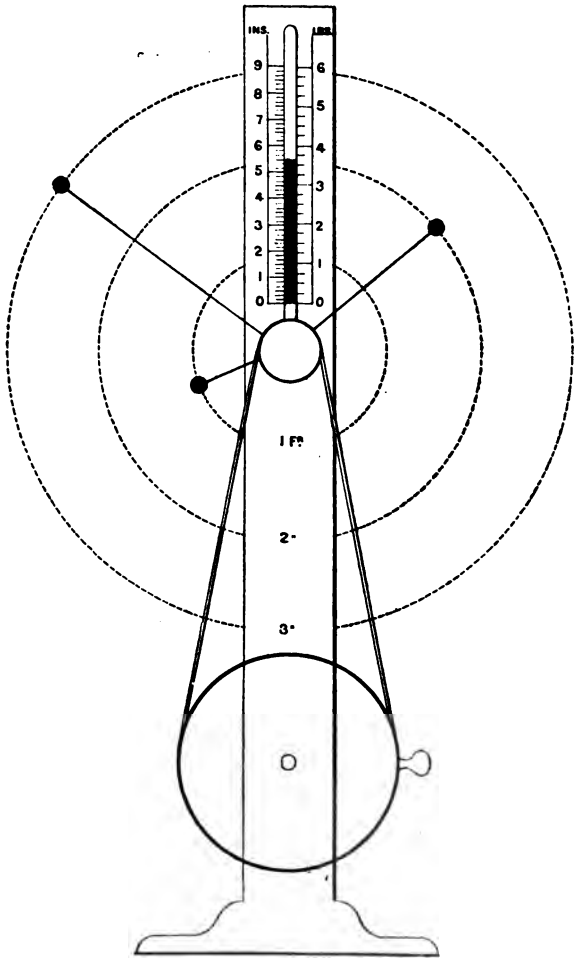
The force-meter to which I invite your attention gauges the five principles governing the movements of a planet, or of a mass put into mechanical circulation.

A small weight, representing a planet in miniature, is suspended from the centre axis by an elastic radius cord, and the weight or pull by gravity is indicated by the attached barometer, and when speed is given to the weight, the rising of the barometer being referred to tabulated numbers prepared, at once determines the results sought:—

GIVEN QUANTITIES—			
Weight, half-ounce.			
Radius	1ft.	2ft.	3ft.
RESULTS—			
Orbit	6ft.	12ft.	18ft.
Velocity	50ft.	50ft.	100ft.
Momentum	78-lbs.	78-lbs.	312-lbs.
Gravity, or centripetal pull	3-lbs.	6-lbs.	6-lbs.
Centrifugal tendency .	3-lbs.	6-lbs.	6-lbs.

showing that, with like velocities, the *strength* of the short

THE FORCE METER.



The Meter, when turned by wheel and pinion, registers results in exact unison with calculations.

radius of attraction must be in inverse proportion to any longer radius of attraction, and demonstrations with various lengths of radius and varied velocity, invariably give the same resulting proportions, and the fact so proved is also demonstrated by geometrical evidence.

From which it may be inferred that the moon, nearly 400 times more distant from the sun than from the earth cannot, with a velocity of a thousand miles a minute, be drawn away from the large circle of 400 radius to course in the small circle of 1 radius unless the pull of the small radius be 400 times as strong as the large radius, and as the earth's attraction with the moon is known to be less than $2\frac{1}{4}$ times the sun's attraction,

The Moon cannot possibly encircle the Earth.

So concluding, I hope I shall be found prepared to answer any questions on points requiring further explanation, either verbally or by written reply to ladies or gentlemen who may please to give thought to this momentous subject.

Thanking you, Sir Henry, and you, ladies and gentlemen, for your patient attention to my disquisition, I now retire, reserving further remarks on the subject for a future communication.

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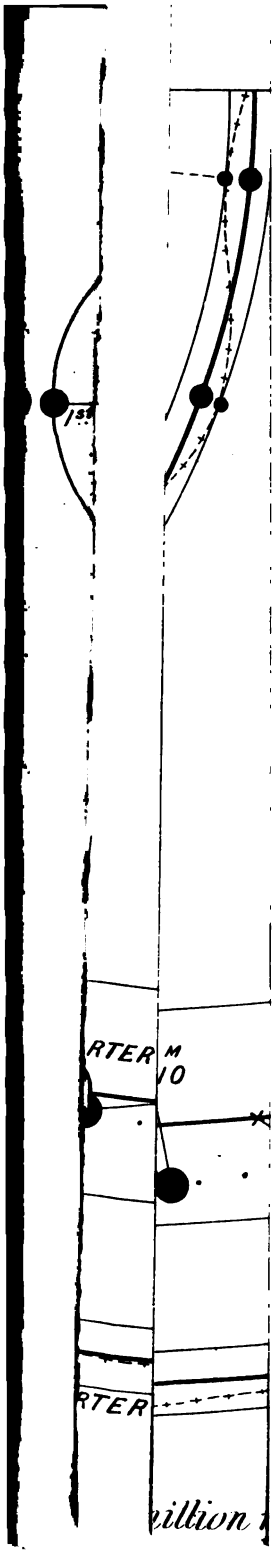
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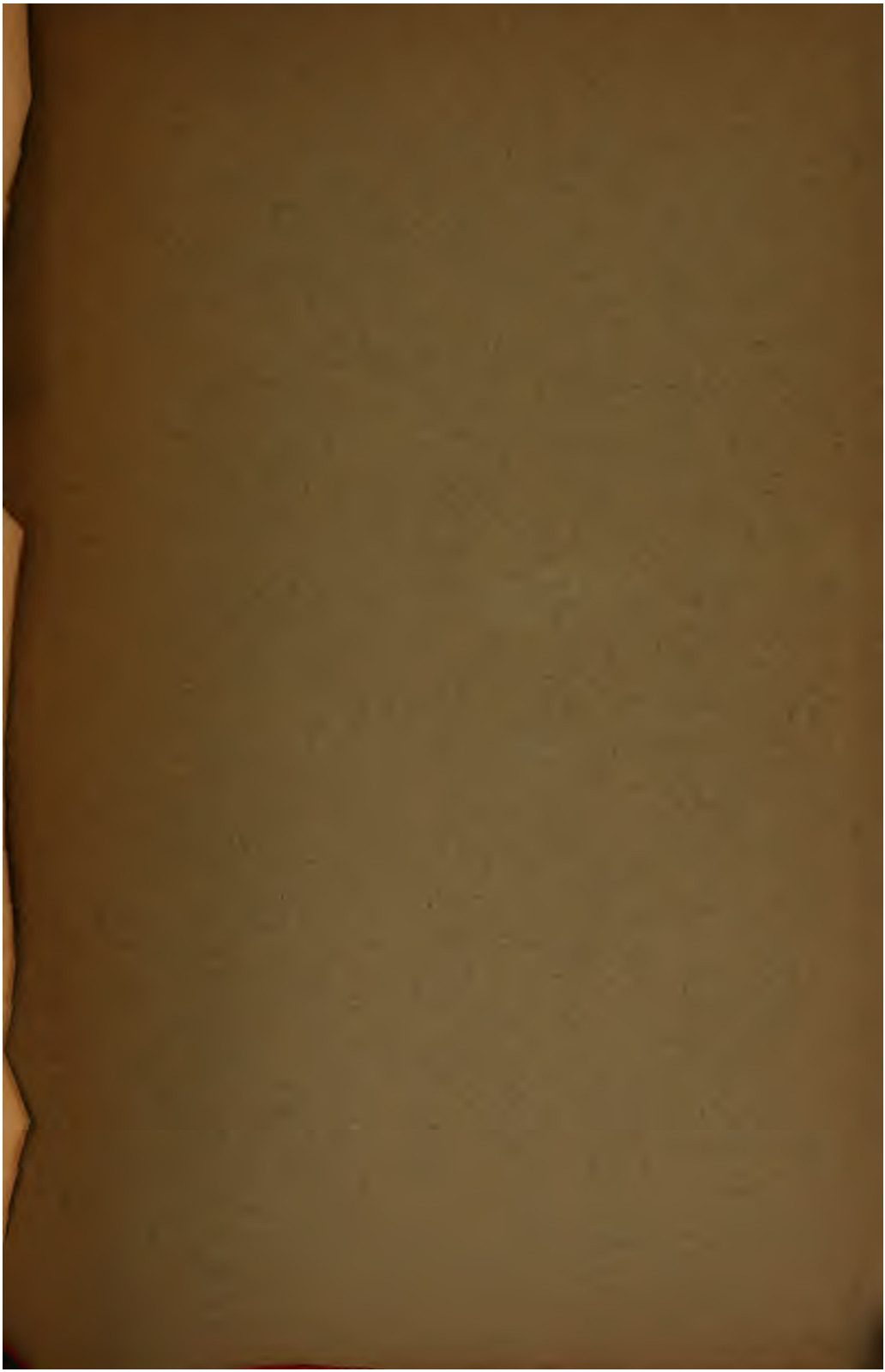

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